CLASS
10

BVPY QUESTION PAPER – STAGE 2

Feb. 07, 2021

Part A – Mathematics (Q1 to Q30)

Part B – Science (Q1 to Q30)

Maximum Marks: 100 **Duration : 180 minutes**

Instructions for Students :

1. This paper consists two parts i.e. Part 'A' (Mathematics) Q.1 to 30, Part 'B'(Science) Q1 to 30.
2. For rough work please use last two pages.

PART 'A' (MATHEMATICS)

SECTION 1 (Maximum Marks: 15)

- This section contains Q.1 to Q. 15.
- Each question has **FOUR** options 'A', 'B', 'C' and 'D'. **ONLY ONE** of these four options is correct
- For each question, marks will be awarded in one of the following categories:

Full Marks : +1 If only the bubble corresponding to the correct option is darkened

Zero Marks : 0 If none of the bubbles is darkened

Negative Marks : –0.25 In all other cases

1. If $8a - 64b - c = 24\sqrt[3]{abc}$, where $a, b, c \neq 0$, then which of the following can be true ?

A. $2\sqrt[3]{a} - 4\sqrt[3]{b} - \sqrt[3]{c} = 0$ B. $2\sqrt[3]{a} = 4\sqrt[3]{b} = \sqrt[3]{c} = 0$

C. $a + b + c = 0$ D. $a = b = c$

2. If $x = 2^{1/3} + 2^{-1/3}$, then the value of $2x^3 - 6x$ will be _____.

A. 5 B. –5

C. 1 D. 0

3. Solve : $(\sin^4\theta - \cos^4\theta + 1)\operatorname{cosec}^2\theta$.

A. 1 B. –2

C. 2 D. 0

4. If the roots of the quadratic equation $x^2 + px + q = 0$ are tan 30° and tan 15° respectively, then the value of $2 + q - p$ is _____.

A. 0 B. 1

C. 2 D. 3

5. A number is chosen at random from 1 to 120. The probability of the number chosen being a multiple of 3 and 15 both is _____.

A. 1/15 B. 1/16

C. 1/17 D. 1/19

6. If $x^2 + px + q = 0$ and $x^2 + qx + p = 0$ have a common root, then _____.

A. $p = q$ B. $1 + p + q = 0$

C. $p + q = 0$ D. Both A and B

7. Two pencils are 24 *cm* and 42 *cm* in length. If we want to make pencils of equal size from them, then the minimum number of similar pencils is _____.

A. 6 B. 11

C. 12 D. None of these

8. Which of the following system of equations has no solution?

A . $3x - y = 2, 9x - 3y = 6$ B . $4x - 7y + 28 = 0, 5y - 7x + 9 = 0$

C . $3x - 5y - 11 = 0, 6x - 10y - 7 = 0$ D . None of these

9. If $P(9a - 2, -b)$ divides the line segment joining $A(3a + 1, -3)$ and $B(8a, 5)$ in the ratio 3 : 1, then the values of a and b respectively are

A . –1, –3 B. –3, 1

C . 1, –3 D. 1, 3

10. If $\sin\theta + \cos\theta = a$, then find the value of $\sin^6\theta + \cos^6\theta$.

A. $\frac{3-4(a^2+1)^2}{4}$ B. $\frac{4-3(a^2-1)^2}{4}$

C. $\frac{4-3(a^2+1)^2}{4}$ D. $\frac{3-4(a^2-1)^2}{4}$

11. Find the values of p and q respectively for which the following system of linear equations has infinite solutions.

$2x + 3y = 7 ; (p + q)x + (2p - q)y = 21$

A. 2, 6 B. –7, 3

C. –3, –5 D. 5, 1

12. The value of $\frac{a+\sqrt{a^2-b^2}}{a-\sqrt{a^2-b^2}} + \frac{a-\sqrt{a^2-b^2}}{a+\sqrt{a^2-b^2}}$ is

A. $\frac{a^2}{b^2}$ B. $\frac{b^2}{a^2}$

C. $\frac{a}{b}$ D. $\frac{2(2a^2-b^2)}{b^2}$

13. What must be subtracted from the polynomial $f(x) = x^4 + 2x^3 - 13x^2 - 12x + 21$ so that the resulting polynomial is exactly divisible by $x^2 - 4x + 3$?

A. $2x - 3$ B. $2x + 3$

C. $x + 3$ D. $3x - 2$

14. A number x is selected from the numbers 1, 2 & 3 and then a second number y is randomly selected from the numbers 1, 4 & 9. What is the probability that the product xy of the two numbers will be less than 9?

A. $\frac{5}{9}$ B. $\frac{9}{10}$

C. $\frac{2}{9}$ D. $\frac{7}{10}$

15. If $47.2506 = 4A + \frac{7}{B} + 2C + \frac{5}{D} + 6E$, then the value of $5A + 3B + 6C + D + 3E$ is _____.

A. 53.6003 B. 53.603

C. 153.6003 D. 213.0003

SECTION 2 (Maximum Marks: 20)

- This section contains Q.16 to Q. 25.
- Each question has **FOUR** options 'A', 'B', 'C' and 'D'. **ONLY ONE** of these four options is correct
- For each question, marks will be awarded in one of the following categories:

Full Marks : +2 If only the bubble corresponding to the correct option is darkened

Zero Marks : 0 If none of the bubbles is darkened

Negative Marks : –0.50 In all other cases

16. if $a^b = b^c = ab$, then $b + c$ always equals

A. $\frac{1}{bc}$ B. $\frac{1}{2}bc$

C. 1 C. bc

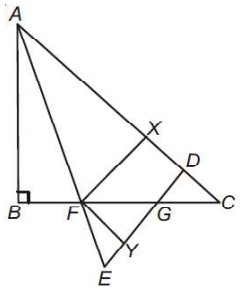
17. A tile is in the shape of a rhombus whose diagonals are $(x + 5)$ units and $(x – 8)$ units. The number of such tiles required to tile on the floor of area $(x^2 + x – 20)$ sq. units is

A. $\frac{2(x+6)}{(x+2)}$ B. $\frac{x+4}{x-8}$

C. $\frac{2(x-4)}{(x-8)}$ D. $\frac{x-8}{x-2}$

18. In the given figure, $\Delta ABC \cong \Delta EDA$. If X and Y are points lying on AD and EG respectively such that $\frac{AX}{XC} = \frac{EY}{YG} = 1$

The value of $\frac{DX}{FY}$ is always



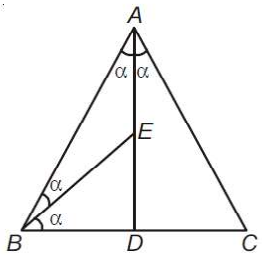
A. Greater than 1

B. Equal to 1

C. Less than 1

D. Equal to $\frac{3}{2}$

19. In the given ΔABC, E is a point on AD. If $\angle AEB$, $\angle ADB$ and $\angle ACD$ are equal to $180^\circ - k_1$, $180^\circ - k_2$ and $180^\circ - k_3$ respectively, then $k_1 : k_2 : k_3$ equals



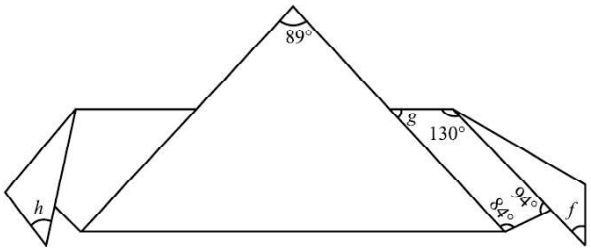
A. 1 : 2 : 3

B. 2 : 3 : 4

C. 3 : 4 : 5

D. 1 : 3 : 5

20. Swati folded the three corners of a triangle. She managed to measure four of the angles as shown below before breaking her protractor. She needs help to figure out what the named angles are. Help her find f, g and h.



	f	g	h
A.	52°	44°	47°
B.	44°	52°	47°
C.	44°	47°	52°
D.	47°	44°	52°

21. The following table gives weekly wages in rupees of workers in a certain commercial organization. The frequency of class 49 - 52 is missing. It is known that the mean of the frequency distribution is 47.2. Find the missing frequency.

A. 40 B. 38

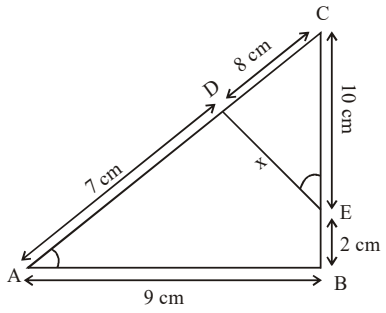
C. 44 D. 42

22. *ABCD* is a parallelogram. The diagonals *AC* and *BD* intersect at a point *O*. If *E*, *F*, *G*, and *H* are the mid-points of *AO, DO, CO* and *BO* respectively, then the ratio of (*EF* + *FG* + *GH* + *HE*) to (*AD* + *DC* + *CB* + *BA*) is _____.

A. 1 : 1 B. 1 : 2

C. 1 : 3 D. 1 : 4

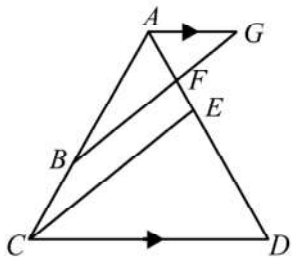
23. In the given figure, $\angle A = \angle CED$. Find the value of *x*.



A. 8 *cm* B. 5 *cm*

C. 7 *cm* D. 6 *cm*

24. In the given figure (not drawn to scale), *AG* is parallel to *CD* and $AG = \frac{2}{7}\ CD$. The point B on *AC* is such that $BC = \frac{2}{7}\ AC$. If the line *BG* meets *AD* at *F* and the line through *C* is parallel to *BG* which meets *AD* at *E*, then find the value of $\frac{FG}{EC}$



A. $\frac{1}{7}$ B. $\frac{3}{7}$

C. $\frac{4}{7}$ D. $\frac{2}{7}$

25. In the xy-plane let A be the point (5,0) and L be the line $y = \frac{x}{3}$. The number of points P on the line L such that triangle OAP is isosceles is (O being the origin)

A. 2 B. 3

C. 4 D. 5

SECTION 3 (Maximum Marks: 15)

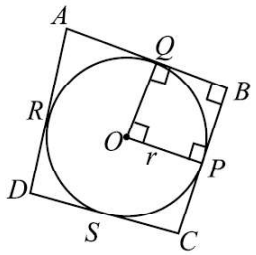
- This section contains Q.26 to Q. 30.
- Each question has **FOUR** options 'A', 'B', 'C' and 'D'. **ONLY ONE** of these four options is correct
- For each question, marks will be awarded in one of the following categories:

Full Marks : +3 If only the bubble corresponding to the correct option is darkened

Zero Marks : 0 If none of the bubbles is darkened

Negative Marks : –1 In all other cases

26. In the given figure, a circle is inscribed in a quadrilateral *ABCD* in which $\angle B = 90°$. If $AD = 23$ cm, $AB = 29$ *cm*, $BC = 25$ *cm* and $DS = 5$ *cm*, then match the columns.



Column-I	Column-II
(A) AQ	(p) 19 cm
(B) radius, r	(q) 14 cm
(C) CD	(r) 18 cm
(D) PC	(s) 11 cm

A. (A) → r, (B) → s, (C) → p, (D) → q B. (A) → r, (B) → p, (C) → s, (D) → q

C. (A) → r, (B) → q, (C) → s, (D) → p D. (A) → p, (B) → q, (C) → r, (D) → s

27. Which of the following is correct?

Statement I : If *a, b, c* are in A.P., then $\frac{1}{bc}, \frac{1}{ca}, \frac{1}{ab}$, are also in A.P.

Statement II : If a constant number is added to each term of an A.P., then the resulting pattern of numbers is also an A.P.

A. Both statement I and statement II are true and statement II is the correct explanation of statement I.

B. Both statement I and statement II are true but statement II is not the correct explanation of statement I.

C. Statement I is true but statement II is false.

D. Statement I is false but statement II is true.

28. Which of the following statements is true?

Statement-1 : The area of the equilateral triangle described on the hypotenuse of a right angled triangle is equal to the sum of the areas of the equilateral triangles described on the other two sides of the triangle.

Statement-2 : The area of the equilateral triangle described on the side of right angled isosceles triangle is half of the area of the equilateral triangle described on its hypotenuse.

A. Only statement-1
B. Only statement-2
C. Both statement-1 and statement-2
D. Neither statement-1 nor statement-2

29. Match the column-I with column-II. If α and β are the zeroes of the quadratic polynomial $f(x) = x^2 - 3x - 2$, then

Column-I	**Column-II**
(i) $\alpha^2\beta + \alpha\beta^2 =$	A. $\frac{4\sqrt{17}-1}{4}$
(ii) $\frac{1}{\alpha}+\frac{1}{\beta} =$	B. -6
(iii) $\alpha - \beta + \frac{1}{2\alpha\beta} =$	C. 161
(iv) $\alpha^4 + \beta^4 =$	D. $-\frac{3}{2}$

A. (i) $\rightarrow$ B., (ii) $\rightarrow$ A., (iii) $\rightarrow$ D., (iv) $\rightarrow$ C.
B. (i) $\rightarrow$ D., (ii) $\rightarrow$ B., (iii) $\rightarrow$ C., (iv) $\rightarrow$ A.
C. (i) $\rightarrow$ B., (ii) $\rightarrow$ D., (iii) $\rightarrow$ C., (iv) $\rightarrow$ A.
D. (i) $\rightarrow$ B., (ii) $\rightarrow$ D., (iii) $\rightarrow$ A., (iv) $\rightarrow$ C.

30. State '*T*' for true and '*F*' for false.

(i) Area enclosed by two concentric circles with radius *R* and *r* respectively such that $R > r$ is $\pi(R^2 - r^2)$.

(ii) The lengths of tangents drawn from an external point to a circle are not equal.

(iii) There is one and only one tangent at any point on the circumference of a circle.

(iv) Ratio of the area of the sector of a circle with central angle 90° to the area of that circle is 1 : 4.

	(i)	(ii)	(iii)	(iv)
A.	F	F	F	F
B.	F	T	F	F
C.	T	F	T	T
D.	T	T	T	T

PART 'B' (SCIENCE)

SECTION 1 (Maximum Marks: 15)

- This section contains Q.1 to Q. 15.
- Each question has **FOUR** options 'A', 'B', 'C' and 'D'. **ONLY ONE** of these four options is correct
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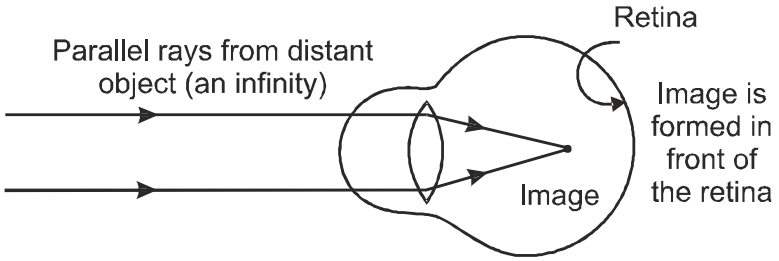
1. An electric current can be produced in a closed loop
   A. By connecting it to a battery, but not by moving a magnet near it
   B. By moving a magnet near it, but not by connecting it to a battery
   C. By connecting it to a battery, as well as by moving a magnet near it
   D. Neither by connecting it to battery nor by moving a magnet near it

2. The phenomenon of electromagnetic induction is
   A. Converting mechanical energy to electrical energy
   B. Inducing current in the coil due to relative motion between a magnet & coil
   C. Converting electrical to mechanical energy
   D. Producing magnetic field

3. A hydrogen bomb is based on
   A. Nuclear fission reaction.
   B. Controlled chain reaction.
   C. Thermonuclear fusion reaction.
   D. None of these

4. Choose the correct statement :
   A. A convex mirror can produce a parallel beam of light from a point source.
   B. A concave mirror can never form a diminished virtual image.
   C. The image formed by a convex mirror can be taken on the screen.
   D. The image of an object placed at the focus of a convex mirror will be formed at infinity.

5. Figure shows the eye suffering from :



A. Hypermetropia
B. Myopia
C. Astigmatism
D. None of these

6. P^{3-} has a larger radius than atom of P because :
A. There is greater coulombic attraction between the nucleus & electrons in the P^{3-} ion.
B. The core electrons in P^{3-} exert a weaker shielding force than those of a neutral atom.
C. The nuclear charge is weaker in P^{3-} than it is in P.
D. The electrons in P^{3-} have a greater coulombic repulsion than those in P atom.

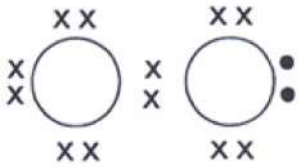
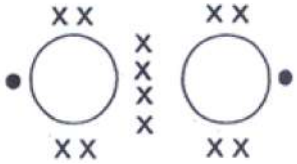
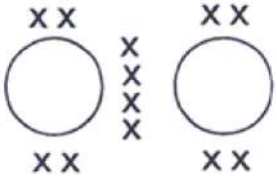
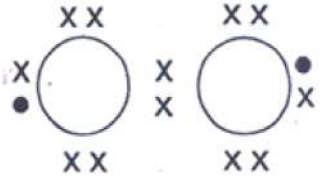
7. The pH of solution X is 1 and that of Y is 2. Which statement is correct about the hydrogen ion concentrations in the two solutions ?
A. $[H^+]$ in X is half that in Y.
B. $[H^+]$ in X is twice that in Y.
C. $[H^+]$ in X is one tenth of that in Y.
D. $[H^+]$ in X is ten times that in Y.

8. Amongst the sixteen √ and × marks, how many cases are incorrect ?

Strip of Metal	0.5M $MgSO_4$	0.5M $ZnSO_4$	0.5M $PbSO_4$	0.5M $FeSO_4$
(i)Mg	×	√	×	√
(ii)Zn	×	×	×	×
(iii)Fe	√	√	√	×
(iv)Pb	√	√	√	√

√ means displacement reaction occurs, × means no displacement reaction occurs
A. 7
B. 11
C. 10
D. 9

9. Which of the following Lewis dot structures best describes the structure of peroxide ion of sodium peroxide ?
X–electrons from oxygen.
•–electrons from sodium

A. 
B. 
C. 
D. 

10. The IUPAC name of $(CH_3)_2$ $CHCH_2$ CH_2 Br is-

A. 1-Bromopentane
B. 2-Methyl-4-bromopentane
C. 1-Bromo -3- methylbutane
D. 2-Methyl-3-bromopentane

11. Double fertilization is

A. Fusion of two male gametes with egg
B. Fusion of one male gamete with egg and the other male gamete with the polar bodies
C. Both are correct
D. Both are incorrect

12. Osmoregulators refers to

A. Regulating salt concentration in blood
B. Regulating water concentration in blood
C. Regulating mineral concentration in blood
D. Both A. and B.

13. Which of the following glands does not occur in pairs ?

A. Ovary
B. Testis
C. Adrenal gland
D. Pancreas

14. In a certain plant, purple flowers are dominant to red flowers. If the cross of two purple–flowered plants produces some purple–flowered and some red–flowered plants, what is the genotype of the parent plants ?

A. PP × Pp
B. Pp × Pp
C. pp × pp
D. pp × PP

15. Junction between two neurons is called

A. Cell junction
B. Neuro muscular junction
C. Neural joint
D. Synapse

SECTION 2 (Maximum Marks: 20)

- This section contains Q.16 to Q. 25.
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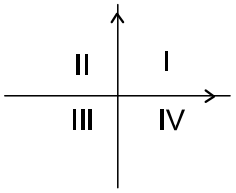
16. An electric heater of 1500 Watt is switched on for 10 hours. The electric energy consumed by the heater is–

A. 5.4×10^7 J
B. 3.6×10^7 J
C. 1.8×10^7 J
D. 0.9×10^7 J

17. Choose correct directions of magnetic fields in I, II, III, and IV quadrants.



A. I, II, inwards III and IV - can't say
B. I, III inwards, IV outwards, II - can't say
C. IV inwards, II outwards, III and I - cant say
D. None of these

18. A concave mirror and a convex lens are held separately in water. Then the focal length of :

A. Convex lens increases whereas that of concave mirror remains unchanged.
B. Concave mirror changes whereas that of convex lens remains unchanged.
C. Convex lens decreases whereas that of concave mirror remains unchanged.
D. Both changes.

19. Neutrons are more effective for producing nuclear reaction with nuclei compared to proton because :

A. Neutrons have greater P.E.
B. Neutrons emit b-particle
C. Neutrons do not experience electrostatic repulsion of nuclear charge or electron cloud
D. Neutrons are bit lighter than protons

20. The electronic configurations of six elements, U, V, W, X, Y and Z are as follows.
Which of the following is incorrect statement?

A. Element V does not react with U, W, X, Y and Z.
B. Compounds UW, ZY, U_2Y show high melting and boiling points.
C. Compounds XW_2, XY and ZW_2 are insoluble in water but soluble in kerosene.
D. Compounds UW and U_2Y do not conduct electricity in solid state.

21. Elements X and Y are both period 3 elements. Element X has three valence electrons and element Y has six valence electrons. Element X reacts with element Y to form compound Z.

What is the formula of compound Z and the bonding in Z?

	Formula of Z	Bonding in Z
A.	XY_3	Covalent
B.	XY_3	Ionic
C.	X_2Y_3	Covalent
D.	X_2Y_3	Ionic

22. Study the given reaction carefully and fill in the blanks by choosing an appropriate option.

$MnO_2 + 4HCl \xrightarrow{\Delta} MnCl_2 + Cl_2 + 2H_2O$

The reaction is an example of **(i)** reaction in which HCl is being **(ii)** and MnO_2 is the **(iii)** agent.

	(i)	(ii)	(iii)
A.	Displacement	Displaced	More reactive
B.	Redox	Oxidised	Reducing
C.	Redox	Oxidised	Oxidising
D.	Double displacement	Reduced	Precipitating

23. Which of the following statement is/are false ?

a. Uric acid increases in muscle cells when they are lacking oxygen.

b. The breathing and respiration in woody parts of plants occurs through lenticles.

c. Pyruvate can be converted into ethanol and carbon dioxide by yeast.

A. Only a
B. Only a and b
C. Only b
D. Only b and c

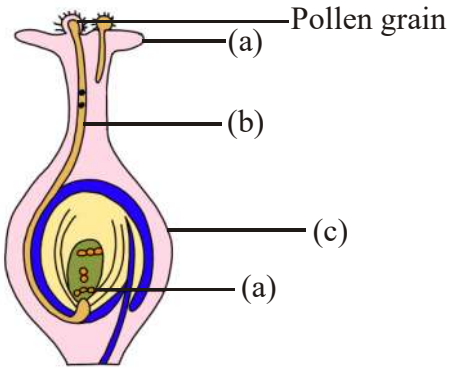
24. A student performed the starch test on a leaf. Some steps involved are

(i) Boil the leaf in water.
(ii) Put iodine on leaf.
(iii) Boil in ethanol.
(iv) washed leaf in water at room temperature.

The correct sequence of steps should be

A. iv, iii, ii, i
B. i, ii, iii, iv
C. ii, iii, iv, i
D. i, iii, iv, ii

25. The following figure represents the germination of pollen on stigma. Label it correctly.



A. (a) Stigma, (b) Ovary, (c) pollen tube, (d) female–germ cell

B. (a) Stigma, (b) pollen tube, (c) Ovary, (d) male–germ cell

C. (a) Stigma, (b) pollen tube, (c) Ovary, (d) female–germ cell

D. (a) Stigma, (b) Ovary, (c) pollen tube, (d) male–germ cell

SECTION 3 (Maximum Marks: 15)

- This section contains Q.26 to Q. 30.
- Each question has **FOUR** options 'A', 'B', 'C' and 'D'. **ONLY ONE** of these four options is correct
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Zero Marks : 0 If none of the bubbles is darkened

Negative Marks : –1 In all other cases

26. You are given a wire 1 m long. In which one of the following cases, the energy drawn from the battery will be the largest ? Assume that the internal resistance of the battery is zero.

A. Full length of the wire connected across the battery

B. Half length of the wire connected across the battery

C. Wire cut into four equal parts and they are connected in parallel to each other across the battery

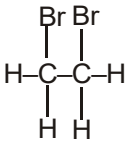
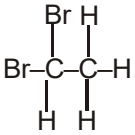
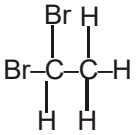
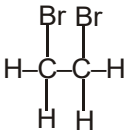
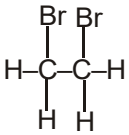
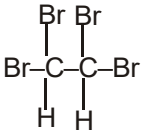
D. Wire is cut into two equal parts and they are connected in parallel to each other across the battery

27. Find the refractive index of a material if angle of incidence of ray of light is 45° and angle of refraction in the material is 30°.

A. 1.41 B. 1.73

C. 1.2 D. 1.5

28. One of the test used to distinguish a saturated from an unsaturated compound is bromine water test. Ethene and ethane are reacted with bromine water and the results are displayed on the table given below. From the following table choose the correct observation.

	Ethene	Ethane
A.	 with decolourisation	 with decolourisation
B.	 with no decolourisation	 with no decolourisation
C.	 with decolourisation	no reaction
D.	No reaction with decolourisation	

29. An organic compound P undergoes the reactions as shown in the given table.

Which of the following statements is correct?

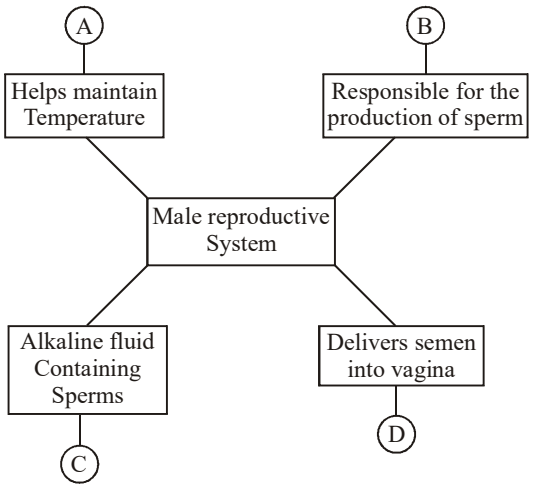
A. Organic compound P is a saturated compound.

B. Compound R undergoes oxidation to form an acid which turns blue litmus red.

C. Reaction III is carried out at room temperature and pressure.

D. None of these.

30. Refer to the above flow chart and choose the incorrect option.



A. A : Suspended dual chambered sack of skin

B. B : Produced testosterone

C. C : Produced in testes

D. D : Used for insemination

Space for rough work

Space for rough work